named in the contract, especially when it is considered that special works had to be erected for the purpose of constructing the telescope.

ROSSE,
T. R. ROBINSON, D.D.
Feb. 19, 1868. WARREN DE LA RUE.

P.S. March 7th, 1868.—I would strongly recommend that the photographic apparatus should be fitted to the telescope before it leaves Ireland.
WARREN DE LA RUE.

The Society then adjourned over the Easter Recess to Thursday, April 23, 1868.

April 23, 1868.

Dr. WILLIAM ALLEN MILLER, Treasurer and Vice-President, in the Chair.

The following communications were read :—

I. "On the Geographical and Geological Relations of the Fauna and Flora of Palestine." By the Rev. HENRY BAKER TRISTRAM, M.A., F.G.S. Communicated by P. L. SCLATER, M.A. Received March 10, 1868.

(Abstract.)

A detailed examination of the fauna and flora exhibits results remarkably in accordance with the views expressed by Mr. Sclater and Dr. Günther on the geographical distribution of species. Palestine forms an extreme southern province of the Palæarctic region.

In every class, however, there are a group of peculiar forms, which cannot be explained simply by the fact of Palestine impinging closely on the Ethiopian, and more distantly on the Indian region, but which require a reference to the geological history of the country.

The results of the examination of the collections made in 1864 by the expedition assisted by the Royal Society, may be tabulated thus :—

	Total.	Palæarctic.	Ethiopian.	Indian, including those which are also Ethiopian.	Peculiar.
Mammalia	82	41	30*	13	7
Aves	326	258	36†	14	27
Reptilia	48	25	13‡	2	4§
Pisces, fluviatile	17	1	3	3	10‖
Mollusca.....	146	48	8	2	81
Flora, general.....	963¶				
Flora, Dead-Sea basin (Phanerogamic)..	113	27	71**	26	3

* Of which 9 are also Indian.
† Of which 8 are also Indian.
‡ Of which 1 is also Indian.
§ And 5 others Asiatic, but not Indian.
‖ Of which 5 are also Syrian and Asia Minor.
¶ About 1300 species are known from Palestine (Phanerogamic).
** Of which 26 are also Indian.

Several of the Ethiopian Mammalia are sedentary forms, and seem to point to an earlier settlement than across the recent deserts. There is no trace of any immigration from the Indian region. Of the peculiar species, *Hyrax syriacus* belongs to an *exclusively* Ethiopian and isolated type, yet is specifically different from its congeners, which are all most sedentary in their habits.

The Avifauna is very rich in number of species, most unequally distributed. The Ethiopian and Indian types are almost exclusively confined to the Dead-Sea basin, excepting only the desert forms. There are several Indian species, as *Ketupa ceylonensis*, which have no affinities with any Ethiopian forms. Of the *peculiar* species, besides several modifications of well-known Palæarctic forms, there are eleven, belonging to as many different Ethiopian and Indian genera. Three of these are decidedly Indian in their affinities. The Avifauna of the Dead-Sea basin is decidedly distinct and typical, sometimes Indian, more generally Ethiopian in its character.

In the Reptilia there is a less prominent intrusion of Ethiopian types, there being a general similarity to the Egyptian herpetological fauna, which must be classed within the Palæarctic region. The Indian is present in *Daboia xanthina*; and the affinities of a new genus *Rhynchocalamus* are rather obscure. Snakes in particular are more limited to the original locality of the individuals, and the groups, like the individuals, are more stationary.

The fluviatile ichthyological fauna is much more distinct, though the number of species is small. In its consideration we confine ourselves to the Jordan and its tributaries, in which are three Nilotic fishes, three others extending eastward in Asia, six to other rivers of Syria, and four peculiar, bearing a strong affinity to the species and genera (as *Chromis* and *Hemichromis*) of tropical Eastern Africa.

Of the Mollusca, most of the peculiar species have no geographical signification. The Pulmonifera have developed in groups, which are modifications of desert types in the south, and of Mediterranean forms on the coast. Variation in this class appears rapidly to follow segregation, as shown by the Jordanic species. The fluviatile mollusca are much more distinct, and indicate a very ancient separation from any adjacent district.

Similar inferences may be drawn from the examination of the Arachnida, Lepidoptera, Hemiptera, and Orthoptera, as well as from the Rhizopod fauna, which is similar to that of the Indian Ocean. (The examination of the Coleoptera is not yet completed.)

The flora of Palestine is, on the coastline and highlands, simply a reproduction of that of the Eastern Mediterranean. That of the Jordan valley is *most* distinct. Of 113 species by the Dead Sea, only 27 are European, and these chiefly weeds of world-wide distribution. In this area the flora is almost exclusively Ethiopian, consisting largely of species extending from the Canaries to India.

Thus in the Dead-Sea basin, an area of but a few square miles, we find a series of forms of life in all classes, differing from those of the surrounding region, to which they do not extend, and having Ethiopian and, more strictly, Indian affinities. The basin is depressed 1300 feet below the sea-level; and as zones of elevation correspond to parallels of latitude, so here a zone of depression represents the fauna and flora of a low latitude. If the flora were *representative*, this law, that climatal zones of life are mutually repeated and represented by elevation or depression and latitude, would account for their existence.

But we have a *transported* flora; this negatives the idea of an independent origin on the spot. The theory of migration, *under present conditions*, is refuted by the coexistence of peculiar and unique forms, with others now found in regions widely apart. Of these, the physical character, and the phenomena of their present distribution, present insuperable obstacles to their migration under *existing* geological conditions.

Their existence must be mainly due to dispersion before the isolation of the area; this must have been after the close of the Eocene period, to which belong the most recent superficial deposits of Southern Palestine. There are no beds synchronizing with the miocene deposits of Sicily, &c.; it must have had a fauna and flora contemporaneous with the miocene flora of Germany. There is geological evidence that since the Eocene period the Jordan fissure has had no connexion with the Red Sea or Mediterranean. There are *subsequent* vast marl deposits of the Dead Sea when it was at a higher level, but they are wholly unfossiliferous. The diminution of the waters may, for reasons given, be fixed about the close of the tertiary epoch. We have also evidence of the extension of the glacial period thus far south, as in the moraines of Lebanon.

Still the lake existed before the glacial epoch in its present form, when there was an unusually warmer climate, and the more antique Ethiopian fauna and flora had a more northerly extension. This would be contemporaneous with the miocene continent of Atlantis, and the Asturian flora of South-west Ireland.

Palestine would then be East African. Afterwards the glacial inroad would destroy the mass of preexisting life, excepting the few species most tenacious of existence which survive in the still comparatively warm depression of the Jordan valley, which thus became a tropical "outlier," analogous to the boreal marine outliers of our own seas. The Indian types are explained by the former continuous miocene continent from India to Africa. The peculiar species may either yet be found in Arabia, or, if not, may be descendants of species which inhabited the country with a limited range, or may be variations stereotyped by isolation.

The peculiar fishes of the Jordan are most important, dating probably from the earliest period after the elevation of the land. The genera of the peculiar species are exclusively African, while the species are *representative* rather than identical. We may explain this by the miocene chain of fresh-

water lakes, extending from Galilee to the Nyanza, Nyassa, and Zambesi, when an ichthyological fauna was developed suited to the warm conditions that prevailed, part of which survives in the Jordan.

During the glacial period the temperature of Lebanon must have been similar to the present Alps, as the existing mammals and birds on the summits are identical with those of the Pyrenees and the Alps; not so the glacial flora, of which almost every trace has been lost. But the flora had not the same powers of vertical migration with the fauna, of which, however, the Elk, Red Deer, and Reindeer, found in the bone-caverns, have long since perished.

During the present period the Mediterranean forms have overspread the whole country, excepting the mountain-tops at an elevation of 9000 feet, and the Jordan depression. These two exceptions can be best explained by the fact that the traces of the glacial inroad are not yet wholly obliterated, and that the preceding warm period has left its yet stronger mark in the unique tropical "outlier" of the Dead-Sea basin, analogous to the boreal outliers of our mountain-tops, the concave depression in the one being the complement of the convex elevation in the other.

II. "New Researches on the Dispersion of the Optic Axes in Harmotome and Wöhlerite, proving these Minerals to belong to the Clinorhombic (Oblique) System." By M. A. L. O. Des Cloiseaux. Communicated by Prof. W. H. Miller, For. Sec. R.S. Received March 12, 1868.

(Abstract.)

We are already acquainted with a considerable number of crystals, natural as well as artificial, the forms of which have only been determined with precision by the examination of their optical properties as doubly refracting bodies. Harmotome and Wöhlerite furnish two fresh examples of this; and they afford all the more important proof of the necessity of appealing to these properties, inasmuch as the crystals of these substances would appear certainly to be derived from a right rhombic prism, so long as we consider only the apparent symmetry of their external forms, or the orientation of the plane containing their optic axes. The different sorts of dispersion which these axes might be capable of presenting are so feeble, and so difficult of appreciation on account of the slight transparency of Wöhlerite, and the complex structure of the crystals of Harmotome, that the determination of these dispersions has hitherto been too incomplete to allow of any conclusion being drawn as to the crystalline type they might otherwise serve to characterize.

It was a remark of M. Axel Gadolin that induced the author to resume the attentive study of the phenomena of dispersion, first in Harmotome, and then in Wöhlerite, and as a consequence to modify the crystallographic type to which these minerals have been in general referred.